Argonne NATIONAL LABORATORY

ANL-09/02 (Summary)

Summary Site Environmental Report

for Calendar Year 2008

Environment, Safety, and Health/Quality Assurance Division

A Message from the Students by Jessica Leone

Biology II students at Downers Grove South High School
In the front row, from left to right, Alyssa Caruso and Jacqueline Svetich. In the middle row, from left to right, Jessica Leone, Kristen Krumwiede, Michaela Grenier, Bledi Dervishi, Matt Kowalski, and Mr. Scott Howard.
In the back row, from left to right, Matt Felsecker, Jimmy Schwabe, Steven Renas, Alyssa Tyrolt, and JoJo Ciancio.

As seniors at Downers Grove South High School and students in Mr. Howard's Biology II class, we have been given the opportunity to showcase our inquiry and research skills by writing a summary report of the 2008 Argonne Site Environment Report. Our purpose in writing this summary is to simplify a lengthy technical report into a short laymen's document the public can more easily understand.

In preparation, we met with Argonne employees David Baurac and Dr. Norbert Golchert to discuss what exactly Argonne is and what Argonne does as a national laboratory. By establishing this connection between us and these Argonne employees, we had them to assist us throughout the project. As a writing team we divided the original Site Environment Report into the most important sections that we wanted to include in our summary.

Throughout this project the team of writers was able to learn more about Argonne and the research being done on its campus. Alyssa Caruso, a participant in this project, noted that, "[the completion of this project] gave students a better understanding of scientific research and its process because we were doing the research firsthand, and applying what we know and have learned to give [our summary of the Site Environment Report] to the public." In completing this project we got a chance to experience what employees of Argonne go through daily. James Schwabe, another participant, felt that this project "was stressful at times, yes, but in the end it was important to go through…" Overall the participants were appreciative for an opportunity to write this report. This project provided us with a newfound understanding of the steps involved in the scientific research process, as well as a chance some of us will never get again, and that is to become published authors.

Table of Contents

For more information about Argonne's Site Environmental Report, contact Norbert Golchert at (630) 252-3912 or ngolchert@anl.gov. For more information about Argonne and its programs, visit the laboratory's World Wide Web site at www.anl.gov or contact Communications & Public Affairs at (630) 252-5575.

Photos by George Joch. The text was edited by David Baurac. Design by Sana Sandler. Layout by Renee Carlson.

What is Argonne? by Alyssa Caruso

Aerial view of the Argonne site. Argonne is a federally funded research and development facility managed by UChicago Argonne, LLC for the U.S. Department of Energy's Office of Science.

History

The University of Chicago's Metallurgical Laboratory, which was part of the World War II Manhattan Project, transformed into Argonne National Laboratory after World War II. At the Metallurgical Laboratory, Enrico Fermi and his colleagues developed the first controlled nuclear chain reaction under Stagg Field at the University of Chicago. In February of 1943, the reactor was moved to Argonne Forest, a section of the Cook County Forest Preserve, where the laboratory that grew up around the reactor became known as "the Argonne Lab."

The laboratory was renamed "Argonne National Laboratory" in 1946. Argonne holds the distinction of being the first national laboratory, and was given the initial mission of developing nuclear reactors for peaceful purposes.

Argonne has been successful in accomplishing this mission. A few of Argonne's early accomplishments include creating the first usable electricity produced by nuclear energy, the first nuclear reactor to light a town with electricity, and the first demonstration of passive safety in a nuclear reactor.

In the late 1940s, Argonne moved to its current location in DuPage County. As years passed Argonne research expanded to include a wide range of basic and applied science and engineering.

Today, Argonne's campus covers 1,500 wooded acres of land. It lies in the southeastern corner of DuPage County, near Lemont, Illinois. Its landscape contains areas of tall grass prairie, oak savanna, oak forest, and wetland habitats.

Argonne Today

Argonne is managed by UChicago Argonne, LLC for the U.S. Department of Energy. Its purpose is to conduct research and development (R&D) in the national interest in support of the Department of Energy. The three broad areas of R&D are basic science, applied science and engineering, and scientific user facilities. Argonne has a diverse staff of 2,800 full-time employees, of which 750 are PhDs; its employees are from 61 different nations, all working to conduct cooperative research in order to solve important national problems.

Argonne and Community

Argonne National Laboratory interacts with the public on a daily basis. About 50,000 people visit Argonne each year. In addition, more than 3,500 students participate in Argonne education programs. Argonne works to inspire the next generation of scientists and engineers through a variety of education programs from kindergarten through the PhD level. Argonne provides both graduate and undergraduate internships as well as postdoctoral appointments and fellowships. For K-12 levels of education, programs at Argonne include

"Introduce a Girl to Engineering Day", "Rube Goldberg Machine Contest", educational field trips, and much more.

Argonne National Laboratory is beneficial to the public in many ways. Attracting more than $600 million annually in federal research funding, providing scientific user facilities for researchers across the nation, creating knowledge for start-up companies, and working with industries to develop new products as well as improving existing ones, are just some of the benefits. Argonne's major R&D programs are focused on solving the nation's energy problems. These programs include basic and applied research in advanced transportation, high-performance computing, and advanced materials.

Argonne research helps support America's economic strength, productivity, and competitiveness in the global marketplace.

Current Research at Argonne by Matthew Kowalski

Aerial view of the Advanced Photon Source (APS).

There are five major facilities used for research at Argonne. Each facility offers state-of-the-art technology for scientists all over the world to conduct research. Below are the five facilities that Argonne National Laboratory offers:

Advanced Photon Source

The Advanced Photon Source (APS) provides the most brilliant beams of X-rays for research in the Western Hemisphere and attracts scientists from all over the nation and the world, because it provides the means for research that they can't do anywhere else in the nation. With 50 beamlines in operation, the APS hosts about 3,500 users per year and has 5,000 total users.

Kaletra, a world-leading drug to fight AIDS, was created with the help of the Advanced Photon Source. The scientists from Abbott Labs who created it knew that creating an effective anti-HIV drug would require precise design. Using the Advanced Photon Source, they determined the structure of a key portion of the HIV virus, then used that knowledge to develop a new biochemical agent that stops the virus from replicating.

Center for Nanoscale Materials

The Center for Nanoscale Materials is Argonne's centerpiece for nanomaterials research. It is a premier user facility that provides expertise and instruments for nanoscience and nanotechnology research. Nanomaterials are about 70,000 times smaller than the diameter of a human hair. At that small size, materials often display new properties of magnetism, conductivity and strength that can lead to useful new materials with applications in medicine, energy and other technologies.

Research at the Center for Nanoscale Materials is expected to lead to new inventions, such as materials that efficiently

NANOCENTER — The Center for Nanoscale Materials is connected to the Advanced Photon Source.

harvest light for energy generation, biosensors to monitor blood sugar levels and inject insulin directly into the bloodstream, and new ways to manipulate photons and electrons that could lead to a whole new class of information storage and processing devices.

Argonne Leadership Computing Facility

The Argonne Leadership Computing Facility is part of the U.S. Department of Energy's effort to provide leadership-class computing resources to the scientific community. The mission of the Argonne Leadership Computing Facility is to accelerate major scientific discoveries and engineering breakthroughs for humanity by designing and providing world-leading computing facilities. The facility is home to Blue Gene/P, a computer that can carry out 556 trillion calculations every second.

One current project taking place at the Argonne Leadership Computing Facility is the study of regional climate changes. Scientists are studying the effects of climate changes on large regions of the planet. To accurately predict what could happen to our world, extremely fast computers are needed to properly calculate the effects of regional climate change.

Electron Microscopy Center

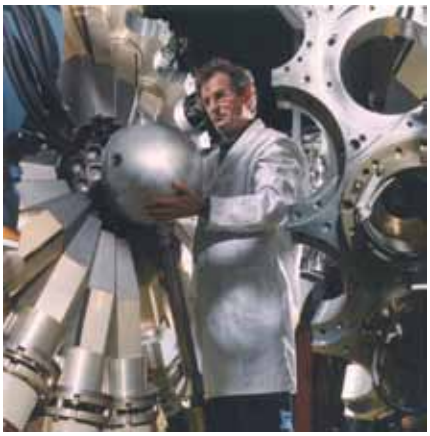
The Electron Microscopy Center develops and maintains unique capabilities for characterizing electron beams and applies those capabilities to solve materials problems. It has much more power and magnification than other microscopes, and it allows scientists to see materials much too small for ordinary microscopes to see.

The Electron Microscopy Center is helping scientists learn how to make higher powered and longer lasting fuel cells, as well as making them at cheaper costs to the consumer.

Argonne Tandem Linac Accelerator Facility (ATLAS)

The ATLAS facility is a leading facility for nuclear structure research in the United States. It provides a wide range of beams for nuclear reaction and structure research to a large community of users from the United States and abroad. It is also home to the gammasphere, which is used to study the structure and behavior of atomic nuclei by observing gamma rays the nuclei emit.

Research at the ATLAS has allowed scientists to discover a new process of dating natural materials. Called radio-krypton dating, this process allows scientists to discover the age of a material based on the levels of radioactive krypton isotopes it contains. This process allows scientists to use much smaller samples to determine the age of a material.



Environmental Monitoring by Matt Felsecker

Argonne National Laboratory is constantly monitoring the environment on its campus and surrounding areas off campus. Argonne takes great care to make sure it is not adversely affecting the environment in any way. Argonne is required by the U.S. Department of Energy, the U.S. Environmental Protection Agency, the Illinois Environmental Protection Agency, and the U.S. Army Corps of Engineers to monitor its output of pollutants into the environment and to meet certain standards to ensure proper protection. For 2008, Argonne met the standards set by these agencies with the exception of a few minor infractions, none of which was greatly detrimental to the environment on or off campus. These minor infractions were detected and reported by Argonne and have either been solved or have plans under development to solve them.

Argonne does all of its monitoring through its Environmental Monitoring (EM) program. The EM is responsible to monitor all standards that are set. The monitoring's main focus is on regulated air emissions, waste water discharge, waste generation and pollution prevention/waste minimization. These areas are significant because they can directly affect the environment.

In monitoring Argonne's air, the EM is mainly looking at the emissions from their five boilers, their backup generators and the methane gas given off from their on-site landfill. These are the things that give off the most significant amount of air pollutants, such as carbon monoxide, nitrous oxides, sulfur dioxide and methane gas. For 2008, none of the equipment operated outside of its allowable discharge limits.

For monitoring wastewater, Argonne's goal is to make sure that no pollutants are making it back into the environment. This is especially important because Argonne does use hazardous chemicals. The wastewater is sampled regularly and tested before and after treatment in Argonne's own treatment plants.

In 2008, the only hazardous organic compounds Argonne detected in Sawmill Creek, where Argonne discharges wastewater from its treatment plants, were various chemicals collectively known as Trihalomethanes (THMs). The THMs are by-products of the chlorinated drinking water Argonne buys from the DuPage Water Commission and their concentrations were well below allowable safety limits.

Argonne's pollution prevention/waste minimization program goes beyond legal requirement and works to make the operations of Argonne as environmentally conscious as possible. This program applied a number of pollution-prevention and waste-minimization methods, including checklists, to all activities, even those operating within legal limits, to reduce pollution emissions and waste production and keep them as low as possible.

Air Monitoring by Kristen Krumwiede

Argonne's research activities use a variety of radionuclides and chemicals that have the potential to negatively affect the environment if released into the air in large enough amounts. The chances of significant emissions being released from research activities at the laboratory are slim because Argonne must comply with EPA regulations, such as the Clean Air Act. Most small discharges into the air at Argonne are estimated rather than monitored; however, the precaution of monitoring the air is taken at Argonne facilities that are likely to produce sufficient emissions.

Argonne follows all laws and regulations to ensure safety from airborne pollutants. One act that Argonne is required to follow is the Clean Air Act, which addresses the release of regulated air pollutants and compliance with air-quality standards for sources like those found at Argonne. The National Emission Standards for Hazardous Air Pollutants (NESHAP) requires Argonne to follow regulations that set forth emission limits and other requirements, such as monitoring, recordkeeping, and reporting. The only NESHAP standards affecting Argonne operations are those for asbestos and radionuclides. There are numerous other acts under Illinois law that comply with air quality and monitoring. Taken together, all these acts regulate a non-polluted environment at Argonne.

Argonne uses 11 air-monitoring stations around the perimeter of its campus and four more off campus to estimate and confirm its emissions of airborne radioactive materials. Air monitoring tracks polluted air emissions to keep Argonne employees and the public safe from any harmful radioactive materials in the air.

Although there are no major emissions of pollution, most of the boilers on site at Argonne burn natural gas which emit small amounts of pollutants and do not require monitoring. However, Boiler No. 5 uses coal during the winter and is monitored for sulfur dioxide while burning coal. This boiler has Argonne's highest potential for significant releases of emissions. Other sources of air pollution on campus are gasoline and ethanol/gasoline blend fuel-dispensing facilities, a dust-collection system, an engine test facility, a surface treatment facility for etching research equipment, a number of diesel generators and a wastewater treatment plant.

Water Monitoring by Alyssa Tyrolt

Many people take water for granted, but making and keeping their water clean enough to drink is a complex process. Water is a key nutrient for any species' survival and a valuable resource to Argonne National Laboratory.

Clean Water Act

The Clean Water Act (CWA) was established in 1977 as an amendment to the Federal Water Pollution Control Act of 1972 and modified by the Water Quality Act of 1987. The CWA provides for the restoration and maintenance of water quality in all water sources throughout the country. The Clean Water Act works to provide the environment with clean, drinkable water. The CWA established the National Pollutant Discharge Elimination System (NPDES), which issues permits and sets standards for the quality of wastewater Argonne is allowed to discharge. Argonne's NPDES permit allows the laboratory to release wastewater from 43 separate outfalls that discharge directly or indirectly into Sawmill Creek. Sawmill Creek is a small natural stream, fed primarily by storm-water runoff, that flows across the Argonne campus. Sawmill Creek water is actually cleaner exiting the Argonne campus than when it arrives.

Keeping Water Clean at Argonne

Argonne processes its wastewater through two treatment systems, a sanitary system and a laboratory system. The sanitary wastewater system collects wastewater from sanitation facilities such as restrooms and cafeteria sinks. This type of wastewater is treated in a biological wastewater treatment system consisting of primary clarifiers, secondary clarifiers, trickling filters and slow sand filters.

Laboratory wastewater generated during research-related activities, such as those that use chemicals and radioactive materials, are collected in retention tanks located in each building and then pumped to the laboratory's wastewater sewer after radiological analysis and release certification.

Monitoring the Water

Argonne routinely monitors their water discharges on and around the site to keep employees, the community, and the environment safe from possible exposure to toxic or radioactive materials used in its research programs. The Illinois Environmental Protection Agency (IEPA) requires Argonne to monitor water quality at points where Argonne discharges water to local streams.

Depending on the outfall, Argonne's sampling intervals range from weekly to semiannual. All samples are collected in specially cleaned and labeled sample bottles with appropriate preservatives added depending on the nature of each sample. Chain-of-custody sheets are used as needed. Collected samples are then submitted to the appropriate lab for analysis, so testing can be completed.

The analyses being conducted on the samples from the NPDES outfalls vary, depending on the permit-mandated monitoring requirements for each outfall. The results of the analyses are compared with the permit limits for each outfall to determine whether they comply with the permit. Argonne complies with all the permit limits in addition to conducting other analyses on samples collected from the combined wastewater outfall to provide a complete evaluation of the impact wastewater has on the environment.

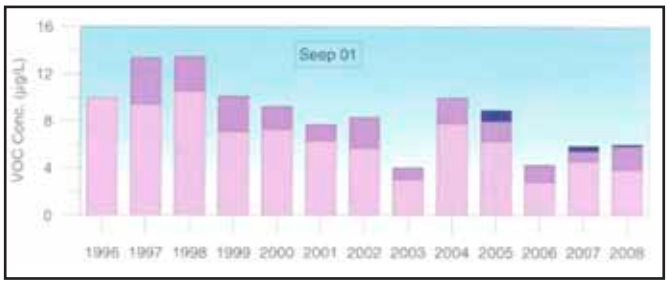
Argonne National Laboratory's routine monitoring of larger emission sources shows that the amount of radioactive material released in the atmosphere is extremely small, resulting in a limited amount of radioactive material to be exposed to the areas surrounding Argonne.

Groundwater by Michaela Grenier

How do processes that occur deep underground affect me? It's not as though I drink the water that is found underground or go swimming in it. So why should I be interested in learning about it? This may be what is going through the minds of some of you readers right now. However, you may be surprised to find that groundwater (water found deep under the surface of the ground) can have a great impact on your daily life.

What is the importance of groundwater to me?

While Argonne no longer uses groundwater as a primary source of drinking water, it still is extremely important. Plants and animals living on Argonne's campus depend on groundwater for their survival. So the quality of Argonne's groundwater is extremely important to these organisms as well as to the plants and animals that make their home in the surrounding Waterfall Glen Forest Preserve. There are several seeps or small pathways for water from Argonne property to flow into



Some of the chemicals monitored in one of the seeps that flow into Waterfall Glen (pink is carbon tetrachloride, light purple is chloroform, dark purple is tetrachloroethene).

ravines in the Waterfall Glen Forest Preserve. The water quality of Waterfall Glen is important not only to the plants and animals living in this ecosystem, but also to the many people who enjoy its beauty. Another reason why groundwater is important is because some groundwater flows from the Argonne campus into the Des Plaines River. This river may be used for fishing or occasional drinking water. For these reasons, Argonne is extremely concerned with the quality of its groundwater and monitors it closely.

Where at Argonne is groundwater found?

Groundwater is found in several different places at Argonne. One source of groundwater at Argonne is the "glacial drift," an area composed of clay, gravel, silt and sand left behind when glaciers retreated thousands of years ago. Within the "glacial drift" are "perched aquifers" that contain larger amounts of sand, gravel and groundwater. Another source of groundwater at Argonne is dolomite bedrock below the glacial drift. This bedrock has lots of cracks and fissures that water flows through. Within the glacial drift and dolomite bedrock are several specific sites where Argonne tests groundwater for different chemicals. One area within the dolomite bedrock is groundwater that serves as a backup water source in case Argonne is unable to receive water from Lake Michigan. In order to monitor the quality of this water and to ensure that it meets drinking water standards, Argonne draws samples from wells and tests them four times a year to check for things like hydrogen-3, alpha and beta radioactivity and volatile organic compounds. Originally, there were four wells; however, due to decreasing need for the wells and equipment failures, only two are left.

800 Area Landfill Monitoring Wells

Other areas that Argonne carefully monitors are sites that previously served as waste management areas. Some examples are the 317/319 area, the 800 Area Landfill (see figure), the East-Northeast Landfill Area and the ravines that flow from the 317/319 Area into the Waterfall Glen Forest Preserve. Most of these areas have already undergone environmental remediation and are now monitored to make sure that the remediation was effective and that no chemicals in the off-site groundwater exceed the limits set by regulation. However, one area, the 317/319 Area, is still in active remediation.

How does Argonne deal with contamination, and what are Argonne s methods of remediation?

The 317 area was used in the 1950s for disposal of liquid chemical wastes, which contaminated the soil there. For several years up until 1969, the 319 Area housed a landfill for solid waste. While both of these areas have gone through a major clean up since the 1980s, the site is still in remediation. In the 319 Area, a clay barrier was placed over the landfill mound and the old waste burial trench to prevent the migration of chemicals and contaminated water into the groundwater system. In addition, Argonne created a phytoremediation system that uses plants to remove contaminated groundwater by evapotranspiration. This phytoremediation project began in 1999 and

continues today. The main plants used for this process are fast-growing willow and hybrid poplar trees.

These areas are carefully monitored through an extensive system of wells. These wells are tested annually for different chemicals, such as metals, pesticides, radionuclides, polychlorinated biphenyl, as well as semivolatile organic compounds. Additional testing is done four times a year to evaluate levels of hydrogen-3 and volatile organic compounds because of the potential health risk these chemicals pose to the surrounding community. While there are still some rather high values for certain volatile organic compounds and hydrogen-3, the overall results of chemical testing show a decrease in these chemicals, indicating that the remediation efforts are improving water quality and stopping the spread of contamination.

What Standards does Argonne s groundwater have to meet?

All groundwater monitoring and testing at Argonne is in accordance with requirements set by the Illinois Environmental Protection Agency and U.S. Environmental Protection Agency. However, Argonne also performs additional voluntary groundwater testing in certain areas such as 317/319 Area.
One other area that Argonne voluntarily monitors is the area around the CP-5 reactor, which was used as a materials research reactor from 1954 to 1979. Argonne now monitors groundwater in this area for radioactive materials and excess amounts of certain chemicals and soluble metals. This is done to ensure that groundwater under the former CP-5 reactor meets Argonne's high standards.

How does Argonne conduct groundwater sampling?

The tests at each groundwater site vary depending on the regulations and standards for that site. The two main methods for collection of water samples use bailers and low-flow sampling systems. A bailer (see photo) is a tube that is lowered into water while attached to a cord. However, bailers can disrupt the water and stir up chemicals. So to get accurate readings, for areas that are easily disturbed, Argonne uses low-flow sampling.

What is the overall quality of groundwater at Argonne?

Argonne strives to maintain the best groundwater quality possible. Based on test results, Argonne seems to be achieving this goal. With the exception of the contamination in 317/319 Area, which is being dealt with, water quality for 2008 appears to be good.

Radiation in General by Bledi Dervishi

In 1895, radiation was discovered by Wilhelm Conrad Röntgen, a German physicist, who, on Nov. 8, 1895, produced and detected electromagnetic radiation in a wavelength range today known as X-rays or Röntgen rays, an achievement that earned him the first Nobel Prize in Physics in 1901.

Today radiation is encountered more frequently than one might expect. Radiation can be found in soils, in our air and water, and in us. Because it occurs in our natural environment, we encounter it every day through the food we eat, the water we drink, and the air we breathe.

There are two major types of radiation: ionizing and non-ionizing radiation.

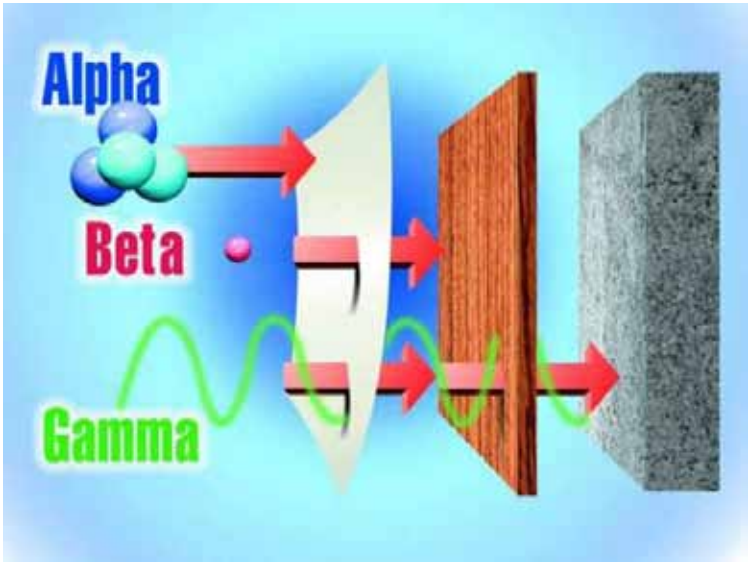
Ionizing

Ionizing radiation is radiation that has enough energy to remove electrons from an atom causing it to charge the atom, or ionize it. This is the type of radiation that people usually think of as 'radiation.' We take advantage of its properties to generate electric power, to kill cancer cells and to use in many manufacturing processes. Ionizing radiation comes in three types: alpha, beta and gamma.

Composed of two protons and two neutrons, the alpha particle is a nucleus of the element helium. Because of its very large mass (more than 7,000 times the mass of the beta particle) and its charge, it has a very short range. Alpha particles aren't used

for radiation therapy because their range is too short, penetrating less than a tenth of a millimeter inside the body. Alpha particles can be stopped by a single sheet of paper. Its main radiation hazard comes when it is ingested into the body.

Beta particles are just electrons from the nucleus, the term "beta particle" being an historical term used in the early description of radioactivity. The high energy electrons have greater range of penetration than alpha particles, but still much less than gamma rays. Beta particles can be stopped by a board of wood. The radiation hazard from betas is greatest if they are ingested.



Gamma radioactivity is composed of electromagnetic rays. It is distinguished from X-rays only by the fact that it comes from the nucleus. Most gamma rays are somewhat higher in energy than X-rays and therefore penetrate deep into many surfaces. It is the most useful type of radiation for medical purposes, but at the same time it is the most dangerous, because it is so powerful. A thick amount of lead can absorb gamma rays, thus stopping it.

Medical uses of radiation include diagnosis, therapy and research. Diagnosis covers a wide range of exams from fairly routine X-rays to complex CT scans. In general, radiation therapy involves delivering a large dose of radiation to a small area of the body. Radiation therapy is used for killing tumor cells as part of cancer treatment. Radiation therapy is also used for treating other diseases, such as coronary artery disease.

Radiation is also used in science. Just as doctors use X-rays to label bones and organs inside people's bodies, scientists can label substances inside plants, animals and even our world.

Radiation has also helped us learn more about a wide variety of things – such as what types of soil certain plants need to grow or the size of newly discovered oil fields and the track of ocean currents. Scientists also use radioactive substances to find the age of ancient objects by a process called carbon dating.

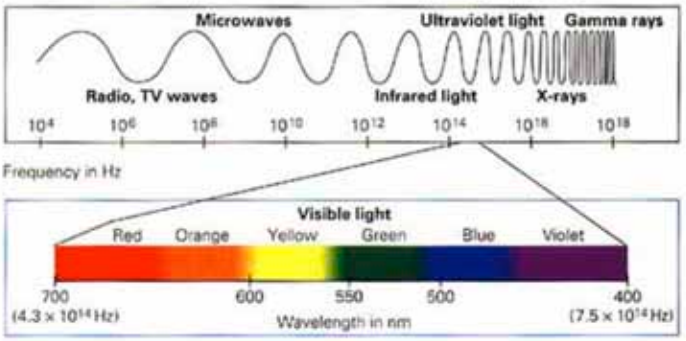
The agricultural industry uses radiation to improve food production. Plant seeds, for example, have been exposed to radiation to bring about new and better types of plants. Besides making plants stronger, radiation can also be used to control insect populations, enabling a decrease in the use of pesticides.

Non-Ionizing

Radiation that has enough energy to move atoms in a molecule around or cause them to vibrate, but not enough to remove electrons, is referred to as "non-ionizing radiation." Examples of this kind of radiation are sound waves, visible light, and microwaves. We use non-ionizing radiation for many common tasks:

- Microwave radiation: heating food.
- Infrared radiation: infrared lamps to keep food warm in restaurants, TV remotes.
- Radio waves: broadcasting radio waves.

Non-ionizing radiation ranges from extremely low frequency radiation, shown on the far left through the audible, microwave and visible portions of the spectrum into the ultraviolet range.



Radiological Monitoring by Jimmy Schwabe

Radiation is a type of energy known to be harmful for the environment. Radiation can cause harmful diseases like cancer and symptoms of intense nausea, headaches and a decrease in white blood cells. Argonne National Laboratory uses radionuclides in its research, so Argonne regulates their use to keep workers and the public in and around Argonne safe.

Radiation in the Air and Water

The main ways in which radioactive material travels through Argonne is via water and air. Argonne uses radioactive material in low concentrations, mostly in research facilities throughout the campus. Argonne regularly measures radionuclide concentrations in the air and groundwater on and off campus to compare on-campus results with natural background levels. Air is monitored with particulate filters at 11 on-campus locations and four off-campus locations. These filters monitor the radionuclide levels in the air to ensure the safety of the facility and its surroundings. The filters are changed weekly and analyzed to make sure the radionuclide emissions are within safety regulations. Off-campus filters provide normal controls to determine if Argonne has added additional radioactivity to the environment.

Argonne also monitors radionuclides in groundwater on its campus. Most water samples collected are acidified with nitric acid and filtered right after collection. Materials from streambeds are also analyzed to determine radionuclide levels. The main collection site is off campus at Sawmill Creek, a small stream that flows across the Argonne site. Radionuclides may enter Sawmill Creek when Argonne discharges water from its wastewater treatments plants into the creek, as permitted by the Illinois Environmental Protection Agency. Although Sawmill Creek is not used by the public directly, the creek empties into the Des Plaines River. The Des Plaines River is an important river for public use and would not be safe if radionuclides leaked into it. To help protect the water quality of the Des Plaines River, Argonne routinely monitors the river for radionuclides. If someone drank only Sawmill Creek water all year, their dose would be 0.02 mrem, which is about 5,000 times lower than the maximum allowable safety limit. If the radiation exposure were to rise, concern would be raised and the source of the radiation sought. Fortunately, Argonne National Laboratory is very cautious and safe with their radiological materials and abides by government regulations in keeping Sawmill Creek and the Des Plaines River safe.

Radiation Rules and Regulations

Argonne is required to comply with the government's strict rules and regulations set by the Department of Energy (DOE) and other federal and state agencies regarding the use of radioactive materials. The Clean Air Act regulates radionuclide emissions because they travel mainly via the air. Radionuclides also travel through water, so Argonne must also comply with the Clean Water Act. The effective dose equivalents for members of the public from all routine

DOE operations, including Argonne's, must not exceed 100 mrem/yr. To maintain this standard, Argonne's long-standing policy is to keep use of radioactive materials as low as reasonably achievable. One measure of Argonne's success is that the maximum possible dose from airborne releases that any member of the general public could have received from Argonne activities in 2008 was 0.034 mrem, which is 300 times lower than the NESHAP 10 mrem/yr maximum standard. Argonne has easily met this standard by keeping the amount of radionuclides it uses to a minimum. Argonne National Laboratory takes pride in meeting the rules and regulations set forth by the government for use of radioactive materials.

Waste Management by Steven Renas

Argonne produced 402,145 lbs of non-radioactive, solid waste in 2008. If not properly disposed of, hazardous waste can be harmful to the environment, including plants, animals and humans. Argonne carefully packs and ships its harmful waste to approved hazardous waste treatment and disposal facilities. Argonne's waste is regulated under the Solid Waste Disposal Act, which regulates the treatment, storage, and disposal of both non-hazardous and hazardous solid waste, as amended by the Resource Conservation and Recovery Act and the Hazardous and Solid Waste Amendments of 1984.

Even though Argonne produces on average 200 tons of solid waste a year, Argonne recycles approximately 14 percent of all solid waste. The Environmental Protection Agency regulates what kind of solid waste can be sent to which landfills. Argonne not only follows these regulations rigorously but also strives to exceed them by finding new ways to deal with solid waste on a daily basis.

Argonne also has many programs that help save energy. Specifically, the Pollution Prevention Program has allowed Argonne to recycle over 82,000 metric tons of materials over the past 5 years. This program has been named one of the best in the U.S. Department of Energy complex due to its efforts.

The Toxic Substance Control Act (TSCA) of 1976 regulates new or already existing chemicals. Specifically, TSCA regulates polychlorinated biphenyl (PCB) products. PCB is used in coolants and transformers which Argonne needs. PCB is highly toxic; however, TSCA regulates it enough to make sure that there is no effect on the environment.

In 2008, Argonne disposed of over 3000 cubic feet of asbestos. Many years ago, asbestos was commonly used in building construction because it has resistance to heat, electrical and chemical damage, sound absorption and tensile strength. In 1989, its use was banned in the United States because it was recognized as a carcinogen. Since then, Argonne has been gradually removing and properly disposing of asbestos as the laboratory renovates and upgrades buildings and other facilities built before asbestos health problems were known.

Habitat Management by Jackie Svetich

Overview

Argonne National Laboratory consists of four habitats; prairie, savanna, oak forest, and wetland. Wetlands are the areas that are flooded by surface or groundwater frequently enough to support certain species of plants, birds, animals and aquatic life. The wetlands in Argonne are federally protected. Throughout all four habitats vegetation is important. Argonne is working to restore acres of high-quality habitat. But more work needs to be done because,

while Argonne's vegetation monitoring data shows improvement, it's not up to par with U.S. Army Corps of Engineers permit requirements.

There are thousands of plant and animal species on the Argonne campus, many of which are protected federally. In any area or habitat, a species can be endangered or threatened. Currently, there are no federally listed threatened or endangered species known on Argonne property. However, there are three federally listed endangered species and one federally listed threatened species in Waterfall Glen Forest preserve, which surrounds Argonne. The Emerald Dragonfly (Somatochlora hineana), Leafy Prairie Clover (Dalea foliosa), Indian Bat (Myotis sodalist) are endangered and the Lakeside Daisy (Tetraneuris herbacea) is threatened. All of these species and their habitats are protected by The Endangered Species Act. The potential impact on the species and critical habitat must be evaluated.

Pollution Problems

Pollution can be a problem in wildlife management. To help minimize pollution from Argonne activities, the laboratory has created programs that divert waste from landfills, conserve energy, improve indoor air quality and reduce operating costs. Argonne also created a Waste-Recycling Program that recycles cardboard, aluminum, glass, plastics, metals, batteries, transparencies, toner cartridges, surplus laboratory chemicals, mixed office paper, lead shielding materials and construction and demolition debris.

Goals for the Future

Argonne's future goals include expanding different habitats and reintroducing native species into areas to reduce habitat maintenance costs, improve erosion and flood control, reduce air pollution and increase biodiversity while preserving areas, such as wetlands, prairie, woodlands and savannas.

Accomplishments

- Argonne has an annual exhibit at Chicago's Field Museum to help inform the public about land management
- Controlled burns and hand-clearing of invasive shrubs are restoring native vegetation in oak woodlands and savannas and reducing soil erosion across the Argonne campus.
- Invasive, non-native vegetation around the pond in front of Argonne's main building has been replaced with native wetland and upland species.
- Six acres of land formerly occupied by buildings were converted to native prairie.

Current Environmental Issues by JoJo Ciancio

Argonne National Laboratory strives to help make the community and the environment around it a safer and healthier place. However, that is easier said than done. Some of the issues that Argonne faces on a daily and yearly basis include:

- making sure the air and water on their campus doesn't become polluted;
- managing waste; and
- making sure the communities around Argonne do not get contaminated with any of their wastes or radionuclide emissions.

Argonne is committed to the health and welfare of the surrounding communities and wildlife and to closely adhering to all laws and regulations.

Argonne is concerned with the amount of emissions that are released into the atmosphere. A heating plant at Argonne gives off an abundance of carbon monoxide, nitrogen and sulfur dioxide gases, the combined effect of which categorizes the laboratory as a major source of air pollutants. By law Argonne is required to follow the Clean Air Act. This act helps Argonne regulate and reduce the amount of toxic emissions it releases into the air so as to keep a healthy environment.

In addition to these emissions, Argonne is continually monitoring the amount of radioactive material it releases into the atmosphere. In 2008, the maximum off-site dose to the general public was 0.0034 mrem, which is nearly 3,000 times less than the EPA standard of 10 mrem. Therefore, Argonne is making sure that the use of radiation at their site is not affecting the environment.

Argonne produces considerable waste on a continuous basis as a result of ongoing projects and scientific experiments. Argonne's Waste Management Operations Department is responsible for the safe collection, treatment, storage and disposal of all regulated waste generated at the laboratory. This includes all types of waste from hazardous waste to transuranic waste. All of the non-hazardous and special waste is disposed of at permitted off-site locations. This ensures that the waste products will not harm the surrounding environment.

Argonne adheres to all environmental policies and standards put forth by the federal, state and local government. For instance, the Clean Water Act of 1977 requires that the water on the site be both "drinkable and swimmable." This means that the water is not contaminated by radioactive materials or toxic waste. The Safe Drinking Water Act of 1974 ensures that public drinking water supplies are free of harmful materials. These regulations are implemented by Argonne to protect the health and safety of its employees. Argonne also documents the potential health and environmental effects of all their chemical wastes, as put forth by the Toxic Substance Control Act.

One of the main problems that Argonne has to face on a yearly basis is the use of salt during the winter months. Too much salt could contaminate the wastewater at Argonne, causing levels of chloride and Total Dissolved Solids (TDS) to exceed Argonne's limit under its National Pollutant Discharge Elimination System permit. Total dissolved solids include sodium, potassium, calcium, phosphates and nitrates, all of which can effect the health of aquatic species. Argonne, however, has made changes to help minimize the TDS levels on campus. They include rerouting a number of cooling tower discharges and building sumps from storm drains to the sewer system and modifying the snow management practices to reduce the use of salt on the site.

Argonne has always put the safety of the public and the environment first and complies with the Resource Conservation and Recovery Act to make sure the environment is safe and not polluted.

Argonne NATIONAL LABORATORY

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